

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Previously Presented) A method for forming a consistency group of data, comprising:
 - receiving a command to form a consistency group with respect to data received at a first storage site that is mirrored to a second storage site;
 - providing a first data structure indicating updates to the first storage site not included in the consistency group that are received after the command;
 - providing a second data structure indicating updates to the first storage site in the consistency group to be formed;
 - transmitting a command to cause data copied to the second storage site that is part of the consistency group to be copied to a third storage site;
 - receiving indication when the data in the second storage site that is part of the consistency group is copied to the third storage site;
 - maintaining a flag indicating which of the first and second data structures to use to indicate updates received after the command to form the consistency group; and
 - toggling the flag to indicate the first or second data structure not currently indicated by the flag, wherein the flag identifies the first or second data structure that indicates updates to the first storage site not included in the consistency group.
2. (Canceled)
3. (Original) The method of claim 1, further comprising:
 - detecting a failure at the second storage site;
 - determining whether the data in the consistency group was copied to the third storage site; and

copying the updates at the first storage site indicated in the first data structure to the third storage site after determining that the data in the consistency group was copied to the third storage site.

4. (Original) The method of claim 3, further comprising:

copying the data at the first storage site indicated in the first and second data structures to the third storage site after determining that the data in the consistency group was not copied to the third storage site.

5. (Previously Presented) The method of claim 4, further comprising:

merging data indicated in the first and second data structures into either of the first or second data structure to indicate data in the consistency group that needs to be copied to the third storage site, wherein the other of the first or second data structure into which the data is not merged is used to indicate updates to data that is not in the consistency group.

6. (Previously Presented) The method of claim 1, further comprising:

synchronously copying updates from the first storage site to the second storage site, wherein the first and second data structures indicate updates to the first storage site that were successfully synchronously copied to the second storage site.

7. (Original) The method of claim 1, wherein the first and second storage sites are separated by a first distance and the second and third storage sites are separated by a second distance, wherein the second distance is substantially greater than the first distance.

8. (Original) A method for forming a consistency group of updates received at a first storage site, comprising:

receiving at a second storage site updates from the first storage site;
providing a first data structure indicating updates at the second storage site to copy to a third storage site;

receiving a command to form a consistency group;
using a second data structure at the second storage site to indicate updates received from the first storage site after receiving the command that are not included in the consistency group to be formed; and

signaling the first storage site in response to copying the updates in the consistency group indicated in the first data structure to a third storage site.

9. (Previously Presented) The method of claim 8, further comprising:
merging indications of updates in the first and second data structures into the first data structure in response to copying the updates in the consistency group indicated in the first data structure to the third storage site; and

indicating in the second data structure updates from the first storage site received after merging the first and second data structures.

10. (Previously Presented) The method of claim 8, further comprising:
continuously asynchronously copying the updates indicated in the first data structure to the third storage site.

11. (Previously Presented) The method of claim 8, further comprising:
determining whether the second data structure is being used to indicate updates from the first storage site not in one consistency group in response to receiving the command to form the consistency group;

merging indications of updates in the first and second data structures in the first data structure in response to receiving the command to form the consistency group and determining that the second data structure is being used to indicate updates from the first storage site not in one consistency group; and

indicating in the second data structure updates from the first storage site received after merging the first and second data structures.

12. (Previously Presented) A system for forming a consistency group of data at a first storage that is in communication with a second storage site, comprising:

a computer readable medium;

means for receiving a command to form a consistency group with respect to data received at the first storage site that is mirrored to the second storage site;

means for providing a first data structure in the computer readable medium indicating updates to the first storage site not included in the consistency group that are received after the command;

means for providing a second data structure in the computer readable medium indicating updates to the first storage site in the consistency group to be formed;

means for transmitting a command to cause data copied to the second storage site that is part of the consistency group to be copied to a third storage site;

means for receiving indication when the data in the second storage site that is part of the consistency group is copied to the third storage site;

means for maintaining a flag in the computer readable medium indicating which of the first and second data structures to use to indicate updates received after the command to form the consistency group; and

means for toggling the flag to indicate the first or second data structure not currently indicated by the flag, wherein the flag identifies the first or second data structure that indicates updates to the first storage site not included in the consistency group.

13. (Canceled)

14. (Original) The system of claim 12, further comprising:

means for detecting a failure at the second storage site;

means for determining whether the data in the consistency group was copied to the third storage site; and

means for copying the updates at the first storage site indicated in the first data structure to the third storage site after determining that the data in the consistency group was copied to the third storage site.

15. (Original) The system of claim 14, further comprising:

means for copying the data at the first storage site indicated in the first and second data structures to the third storage site after determining that the data in the consistency group was not copied to the third storage site.

16. (Previously Presented) The system of claim 15, further comprising:

means for merging data indicated in the first and second data structures into either of the first or second data structure to indicate data in the consistency group that needs to be copied to the third storage site, wherein the other of the first or second data structure into which the data is not merged is used to indicate updates to data that is not in the consistency group.

17. (Previously Presented) The system of claim 12, further comprising:

means for synchronously copying updates from the first storage site to the second storage site, wherein the first and second data structures indicate updates to the first storage site that were successfully synchronously copied to the second storage site.

18. (Original) The system of claim 12, wherein the first and second storage sites are separated by a first distance and the second and third storage sites are separated by a second distance, wherein the second distance is substantially greater than the first distance.

19. (Original) A system for forming a consistency group of updates received at a first storage site, wherein the system is located at a second storage site in communication with the first storage site, comprising:

a computer readable medium;

receiving at a second storage site updates from the first storage site;

providing a first data structure in the computer readable medium indicating updates at the second storage site to copy to a third storage site;

receiving a command to form a consistency group;

using a second data structure in the computer readable medium to indicate updates received from the first storage site after receiving the command that are not included in the consistency group to be formed; and

signaling the first storage site in response to copying the updates in the consistency group indicated in the first data structure to a third storage site.

20. (Previously Presented) The system of claim 19, further comprising:

means for merging indications of updates in the first and second data structures into the first data structure in response to copying the updates in the consistency group indicated in the first data structure to the third storage site; and

means for indicating in the second data structure updates from the first storage site received after merging the first and second data structures.

21. (Previously Presented) The system of claim 19, further comprising:

means for continuously asynchronously copying the updates indicated in the first data structure to the third storage site .

22. (Previously Presented) The system of claim 19, further comprising:

means for determining whether the second data structure is being used to indicate updates from the first storage site not in one consistency group in response to receiving the command to form the consistency group;

means for merging indications of updates in the first and second data structures in the first data structure in response to receiving the command to form the consistency group and determining that the second data structure is being used to indicate updates from the first storage site not in one consistency group; and

means for indicating in the second data structure updates from the first storage site received after merging the first and second data structures.

23. (Currently Amended) A computer readable medium including code executed by a processor complex to form a consistency group of data, wherein the computer readable medium is implemented at a first storage site in communication with a second storage site, and wherein the code causes operations to be performed at the first storage site, the operations comprising:

receiving a command to form a consistency group with respect to data received at a first storage site that is mirrored to [[a]] the second storage site;

providing a first data structure indicating updates to the first storage site not included in the consistency group that are received after the command;

providing a second data structure indicating updates to the first storage site in the consistency group to be formed;

transmitting a command to cause data copied to the second storage site that is part of the consistency group to be copied to a third storage site;

receiving indication when the data in the second storage site that is part of the consistency group is copied to the third storage site;

maintaining a flag indicating which of the first and second data structures to use to indicate updates received after the command to form the consistency group; and

toggling the flag to indicate the first or second data structure not currently indicated by the flag, wherein the flag identifies the first or second data structure that indicates updates to the first storage site not included in the consistency group.

24. (Canceled)

25. (Previously Presented) The computer readable medium of claim 23, wherein the operations further comprise:

detecting a failure at the second storage site;

determining whether the data in the consistency group was copied to the third storage site; and

copying the updates at the first storage site indicated in the first data structure to the third storage site after determining that the data in the consistency group was copied to the third storage site.

26. (Previously Presented) The computer readable medium of claim 25, wherein the operations further comprise:

copying the data at the first storage site indicated in the first and second data structures to the third storage site after determining that the data in the consistency group was not copied to the third storage site.

27. (Previously Presented) The computer readable medium of claim 26, wherein the operations further comprise:

merging data indicated in the first and second data structures into either of the first or second data structure to indicate data in the consistency group that needs to be copied to the third storage site, wherein the other of the first or second data structure into which the data is not merged is used to indicate updates to data that is not in the consistency group.

28. (Previously Presented) The computer readable medium of claim 23, wherein the operations further comprise:

synchronously copying updates from the first storage site to the second storage site, wherein the first and second data structures indicate updates to the first storage site that were successfully synchronously copied to the second storage site.

29. (Previously Presented) The computer readable medium of claim 23, wherein the first and second storage sites are separated by a first distance and the second and third storage sites are separated by a second distance, wherein the second distance is substantially greater than the first distance.

30. (Previously Presented) A computer readable medium including code executed by a processor complex to form a consistency group of updates received at a first storage site, wherein the computer readable medium is implemented in a second storage site in communication with the first storage site, and wherein the code causes operations to be performed, the operations comprising:

receiving at a second storage site updates from the first storage site;
providing a first data structure indicating updates at the second storage site to copy to a third storage site;
receiving a command to form a consistency group;
using a second data structure at the second storage site to indicate updates received from the first storage site after receiving the command that are not included in the consistency group to be formed; and
signaling the first storage site in response to copying the updates in the consistency group indicated in the first data structure to a third storage site.

31. (Previously Presented) The computer readable medium of claim 30, wherein the operations further comprise:

merging indications of updates in the first and second data structures into the first data structure in response to copying the updates in the consistency group indicated in the first data structure to the third storage site; and

indicating in the second data structure updates from the first storage site received after merging the first and second data structures.

32. (Previously Presented) The computer readable medium of claim 30, wherein the operations further comprise:

continuously asynchronously copying the updates indicated in the first data structure to the third storage site.

33. (Previously Presented) The computer readable medium of claim 30, wherein the operations further comprise:

determining whether the second data structure is being used to indicate updates from the first storage site not in one consistency group in response to receiving the command to form the consistency group;

merging indications of updates in the first and second data structures in the first data structure in response to receiving the command to form the consistency group and determining that the second data structure is being used to indicate updates from the first storage site not in one consistency group; and

indicating in the second data structure updates from the first storage site received after merging the first and second data structures.